D-meson production as a function of transverse spherocity in pp collisions at $\sqrt{s}$ = 13 TeV with ALICE

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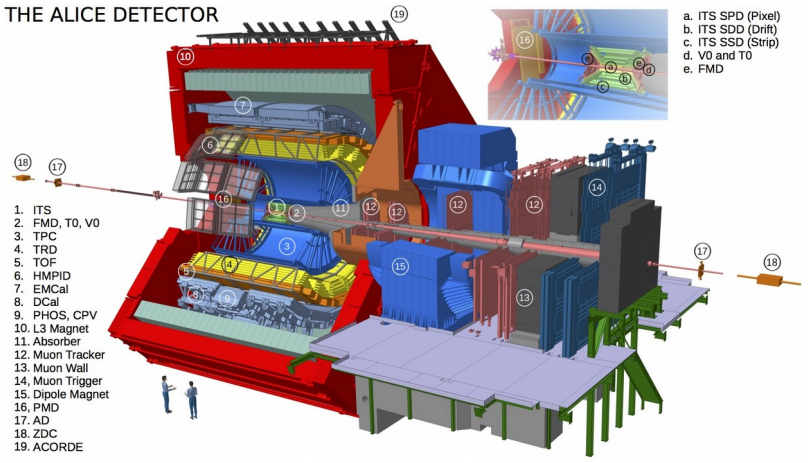
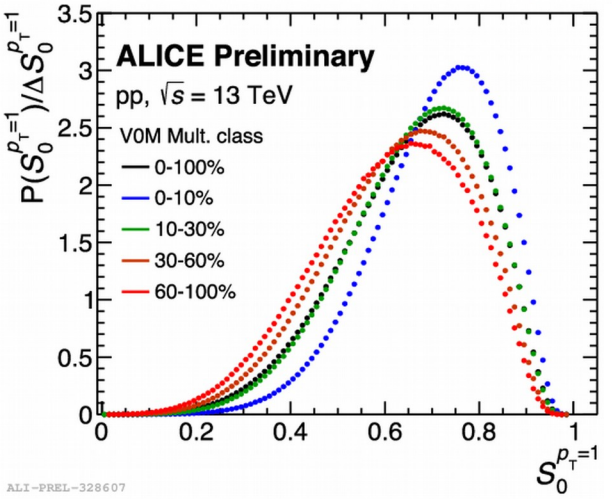
Physics motivation

- Spherocity is an event shape observable

$$S_o^{(p_T=1.0)} = \frac{\pi^2}{4} \min_{\hat{n}=(n_x,n_y,n_y)} \left(\frac{\sum_i |\hat{p}_{T_i\,(p_T=1.0)} \times \hat{n}|}{N_{tracks}} \right)^2$$

  - $S_0 \rightarrow 0$ (**Jetty** limit, Dominated by **hard** QCD processes)
  - $S_0 \rightarrow 1$ (**Isotropic** limit, dominated by **soft** QCD processes)
- Event shapes sensitive to initial hard scatterings and underlying events.
- Characterising charm production in pp collisions through D mesons production, event multiplicity and event shapes.
- High multiplicity pp collisions are primarily dominated by isotropic events, whereas events with low multiplicity are more likely to be jetty than high-multiplicity events.





Analysis Methodology

- Datasets: **pp, $\sqrt{s}$ =13 TeV** (L_{int} =31.9 ± 0.5 nb^{-1})

- Spherocity track selections
  - 3 tracks with p_T > **0.15** GeV/*c* within $|\eta|$ < **0.8**
  - TPCOnly Track Cuts + TPCrefit **(FB 1)**

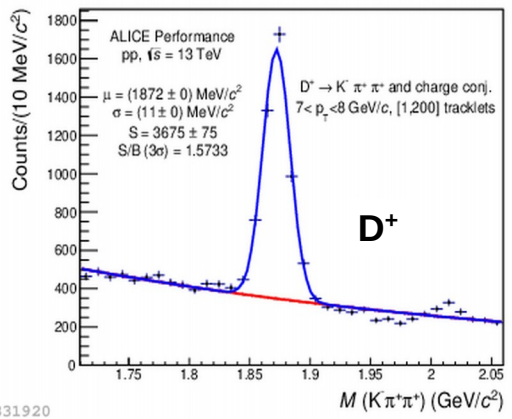
- Particles are identified using PID information from **TPC** and **TOF** to reduce background at low p_T.

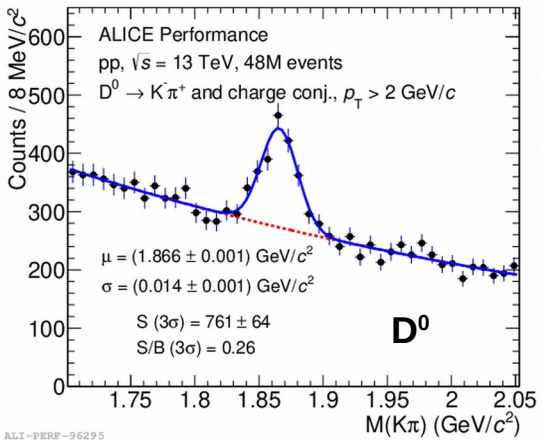
- D mesons are reconstructed after PID and topological selections via invariant mass fit in the following decay channels

  $\mathbf{D^+ \rightarrow K^- \pi^+ \pi^+}$

  $\mathbf{D^0 \rightarrow K^- \pi^+}$

  $\mathbf{D^{*+} \rightarrow D^0 \pi^+}$





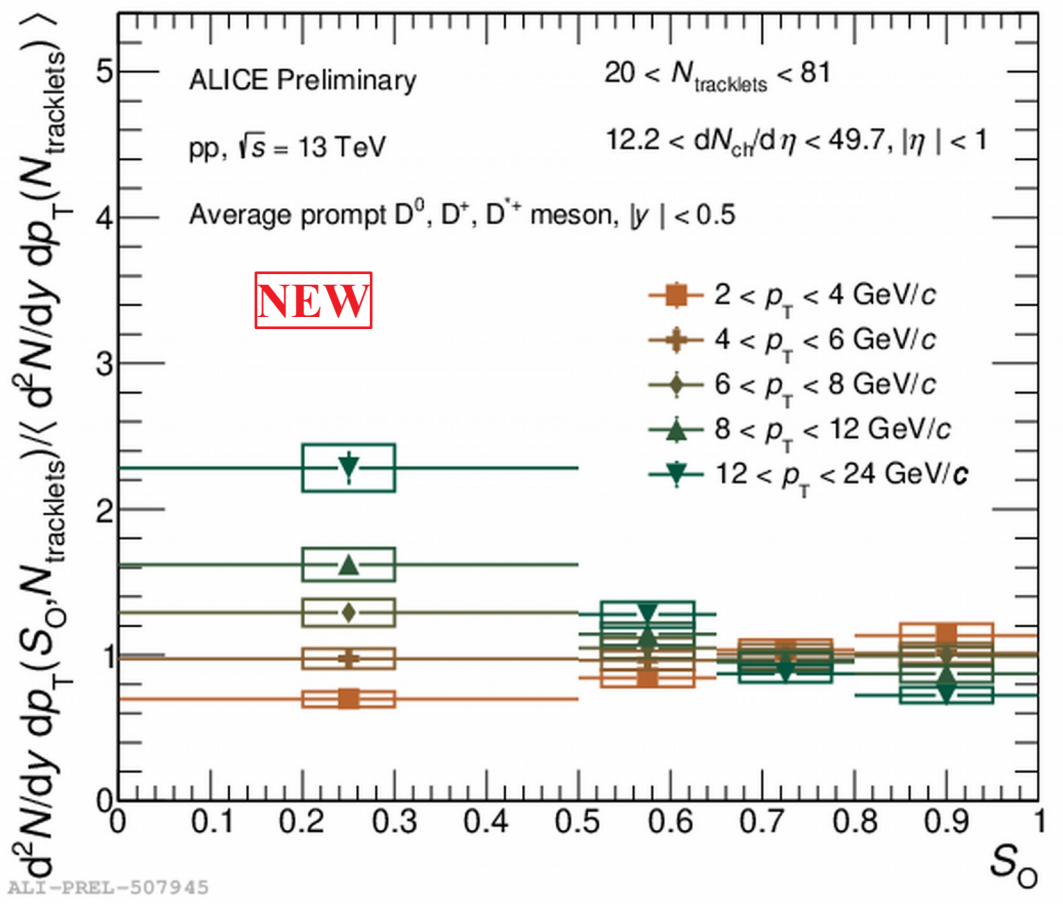
- D mesons self normalised yields is defined as

$$Y_{corr}^{mult\ sphero} = \left(\frac{1}{N_{events}^{i,j}} \frac{N_{raw\ D}^{i,j}}{\varepsilon_{prompt\ D}^{i,j}} \right) / \left(\frac{1}{\langle N_{events}^{j} \rangle} \frac{\langle N_{raw\ D}^{j} \rangle}{\varepsilon_{prompt\ D}^{j}} \right)$$

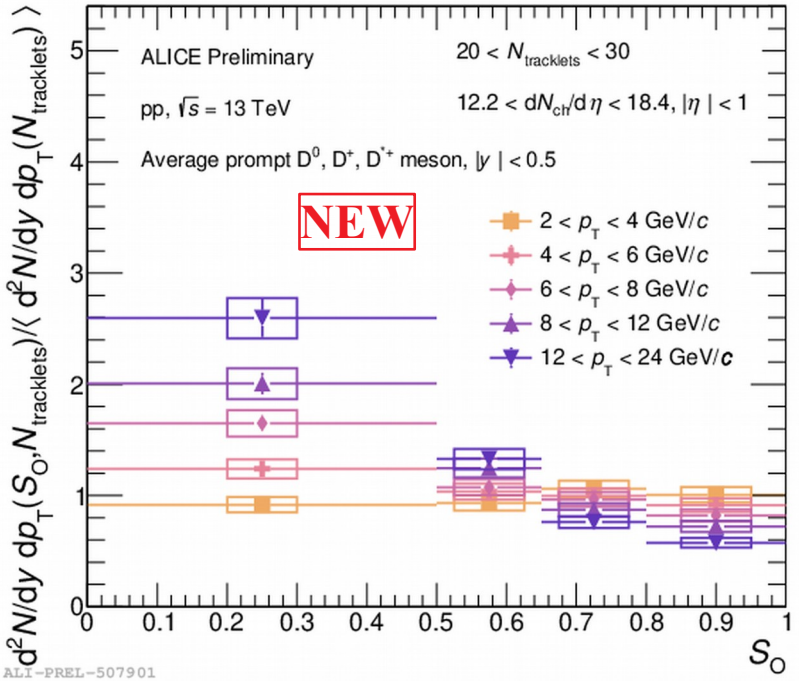
$N^{i,j}_{raw\ D}$ is the extracted raw yield, $\varepsilon^{i,j}_{prompt\ D}$ is the acceptance × efficiency, $N^{i,j}_{events}$ is the number of events. The numerator is normalised to the corresponding quantity for INEL > 0.

Results

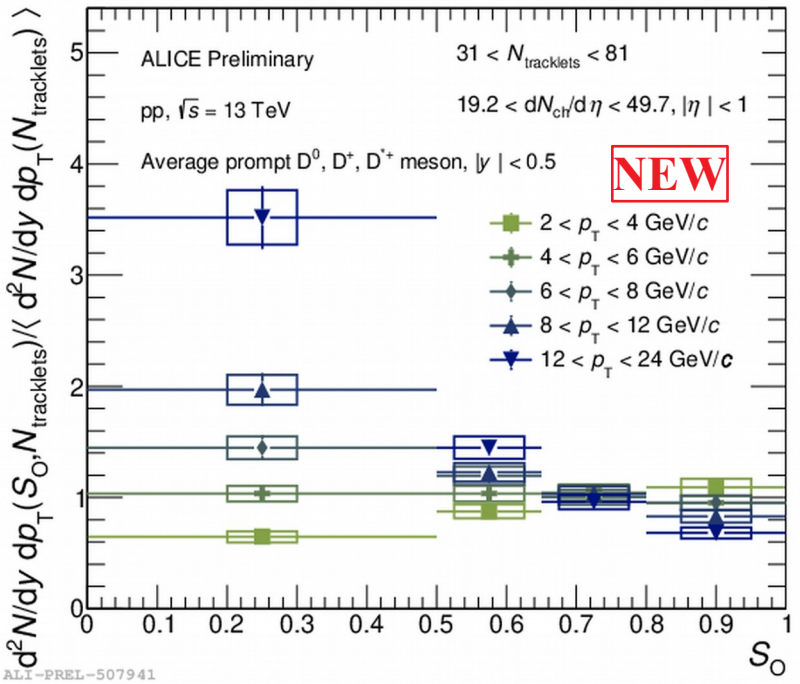
- The results isolate D mesons production in hard and soft processes in different p_T and N_{trk} intervals.
- Production of D mesons at low p_T is more likely to be observed in isotropic events.
- High p_T D mesons production is favoured in jetty events.



Results



- Jetty like D mesons production dominates in high p_T intervals.
- An enhancement of jetty-like D mesons production is observed at high multiplicity.



Conclusion

- The self normalised yield of D mesons as a function of transverse spherocity (S_o) is highest for the jetty events.
- The production of D mesons in jetty events is different from isotropic ones. High $\boldsymbol{p_T}$ production dominates the jetty region whereas low $\boldsymbol{p_T}$ production is dominant towards isotropic side.
- These results suggest that spherocity acts as a nice tool to differentiate events dominated with soft versus hard particle production.

THANKS